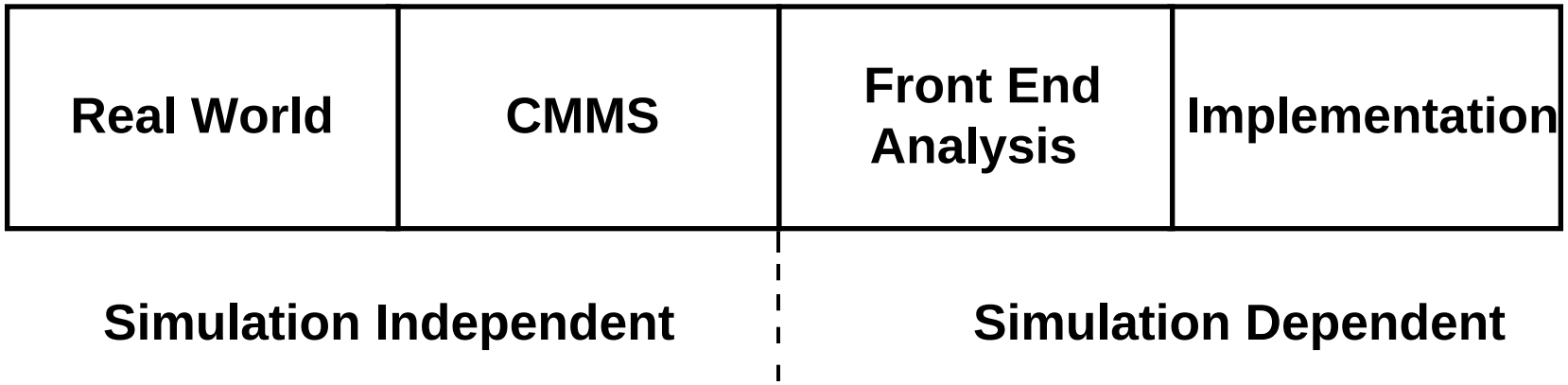
CMMS

DMSO

Simulation Development Process



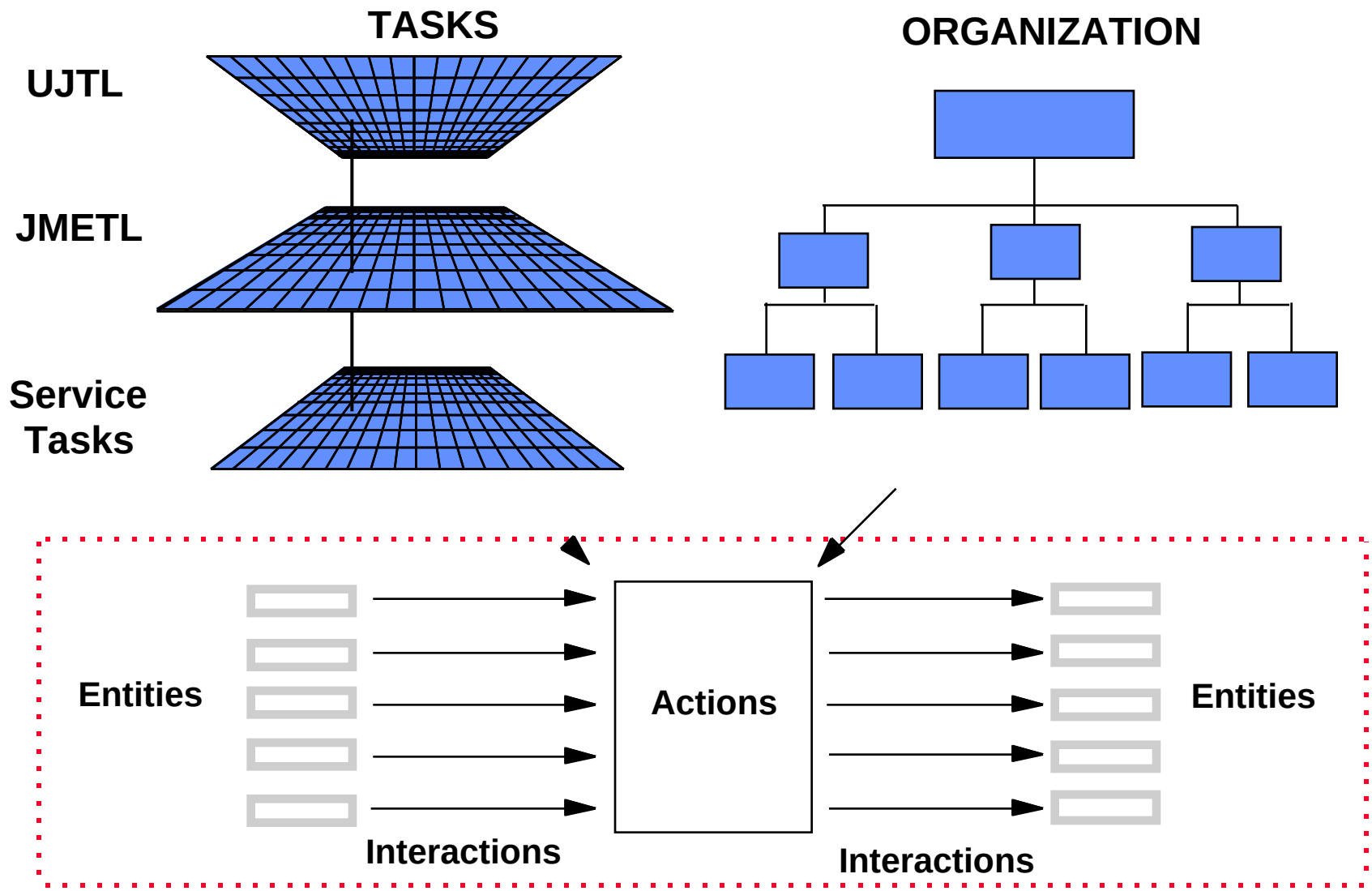
What is a CMMS?

DMSO

- A hierarchical description of the actions and interactions among the various entities associated with a particular mission area
- An authoritative first abstraction of the real world
- A common framework for knowledge acquisition
  - Validated, relevant actions and interactions organized by specific task and entity/ organization
  - Standard format for expression
- The purpose of CMMS is to cost-effectively provide simulation developers (and others) a common understanding of the real world

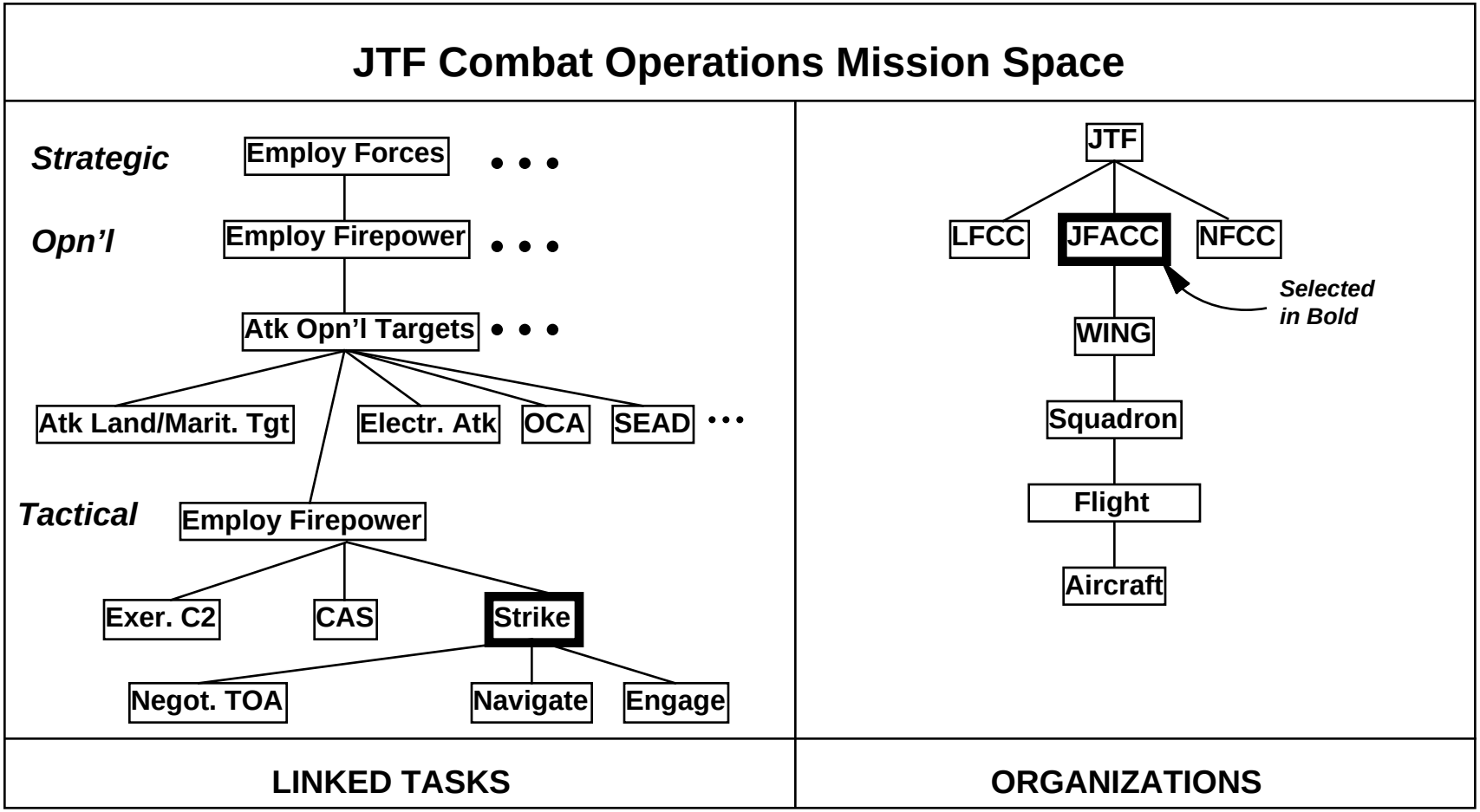
Organizational Concept

DMSO



CMMS Illustrative Example
Interaction Selection Display

DMSO



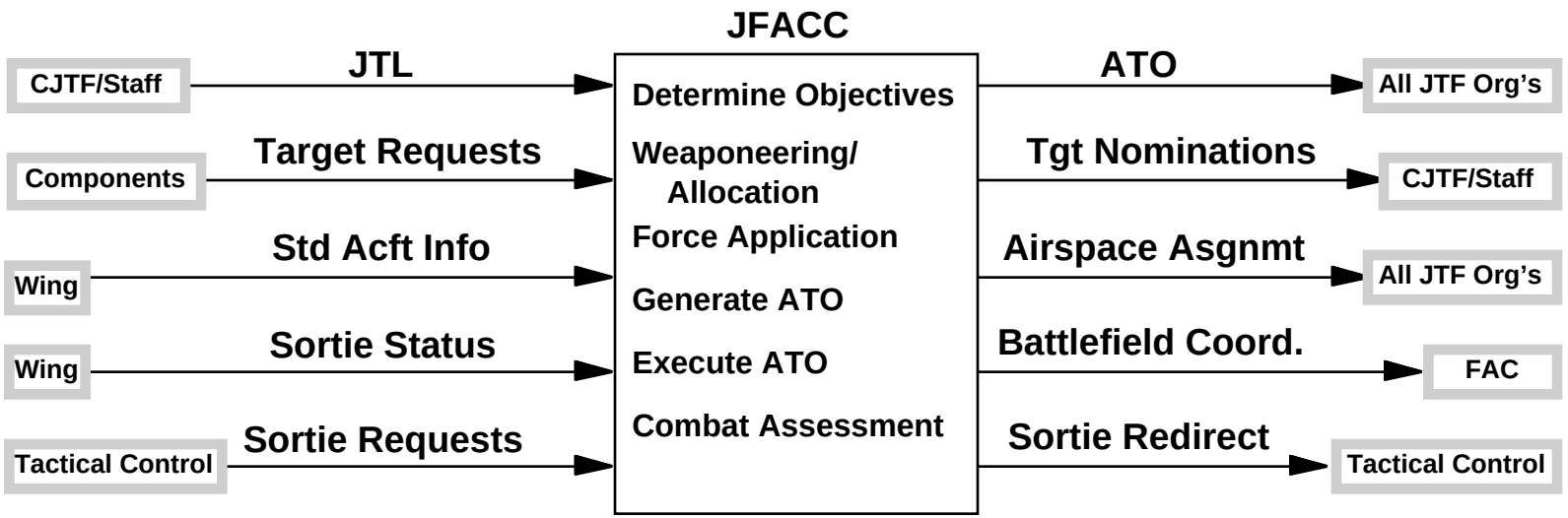
User Selects Interactions Involved in the Strike Task by the JFACC ...

Illustrative Example

DMSO

Interaction Display

JTF Combat Operations Mission Space



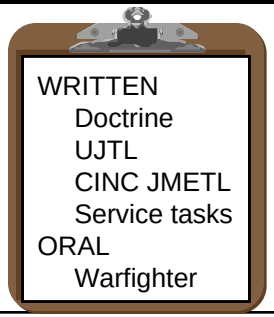
... Display Shows All Actions and Interactions for the Selection, in the Mission Space

CMMS Prime Components

DMSO

INFORMATION SOURCES

Feedback to authoritative sources



KA Analysts

CAPTURED KNOWLEDGE

DIF

CMMS Users

USER INTERFACES

- Multiple user-requested views
  - Organization structure
  - Task structure
  - Model of interactions
  - Visualization of combat process
- Performance demands
  - Response time
  - Refresh rate
- User-friendliness

DATABASE

- CMMS elements:
  - Entities
  - Actions
  - Interactions
- Pointers to:
  - Knowledge acquisition history
  - Auth. Sources
  - Applicable models and simulations

MANAGEMENT PROCESS/TOOLS

- CMMS element integration
- Warfighter approval
- Functional area mission space mgt
- Resource/tool management

KNOWLEDGE CONVERSION PROCESS/TOOLS

- Check source, format, content
- Extract CMMS elements
- Deficiency correction
- Tool guidance
- Store in temporary database
- Convert CMMS elements for export

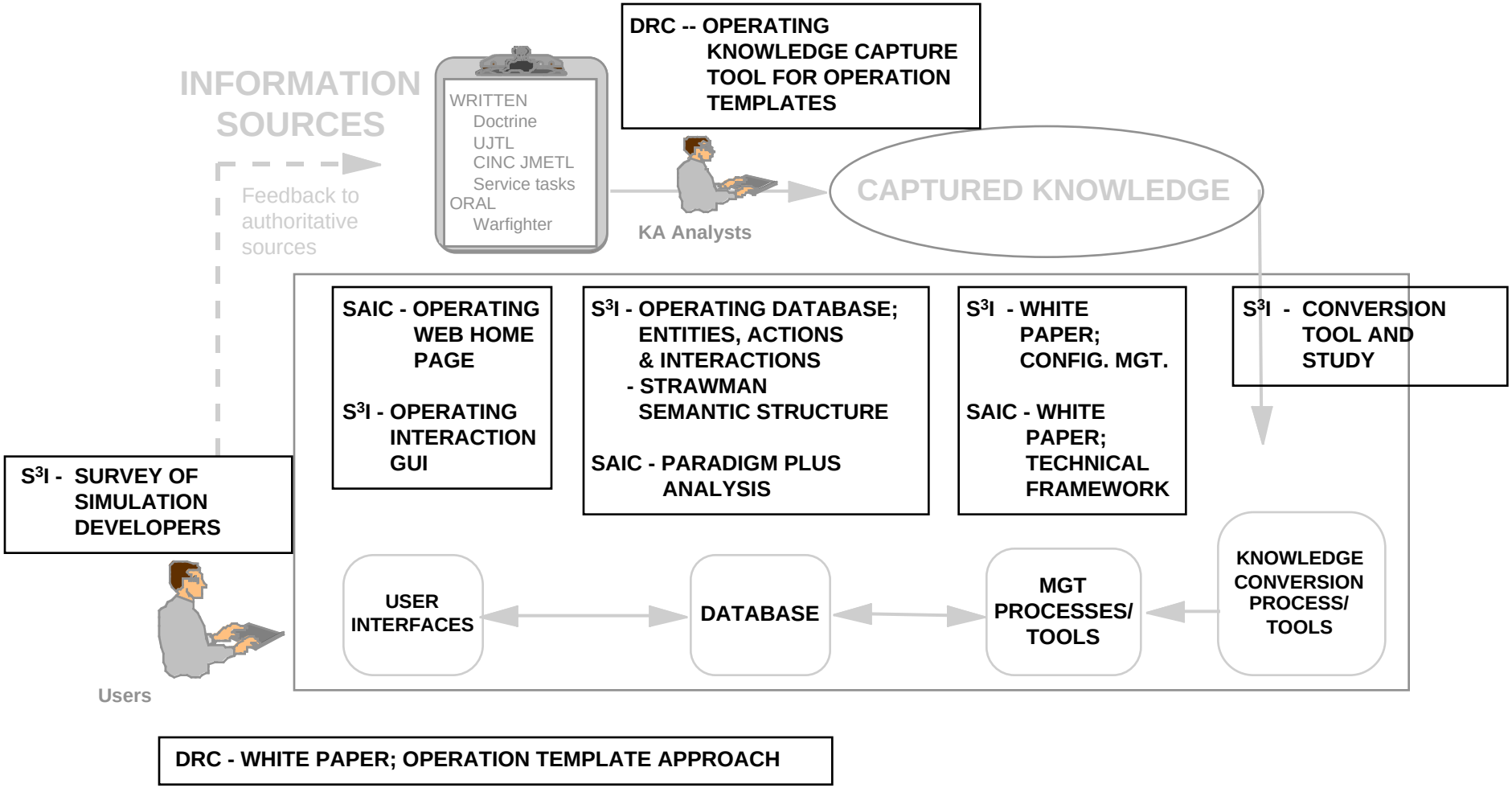
CMMS SYSTEM

Data comprising CMMS resides in and is accessible through the MSRR

CMMS Experiment Phase

DMSO

DRC, S3I and SAIC explored each area of the CMMS process with very limited data fill



Prototype Task

DMSO

- Contractor team selected
  - Software development capability
  - Combat mission space experience and connectivity
  - UJTL applications
- Rapid prototyping development
  - 2 spirals of development and user feedback
  - Generate understanding of requirements for fully operational CMMS
- Each spiral
  - Requirements analysis
  - Architecture analysis
  - Design/code
  - Demonstration and feedback from prospective users
- Final report

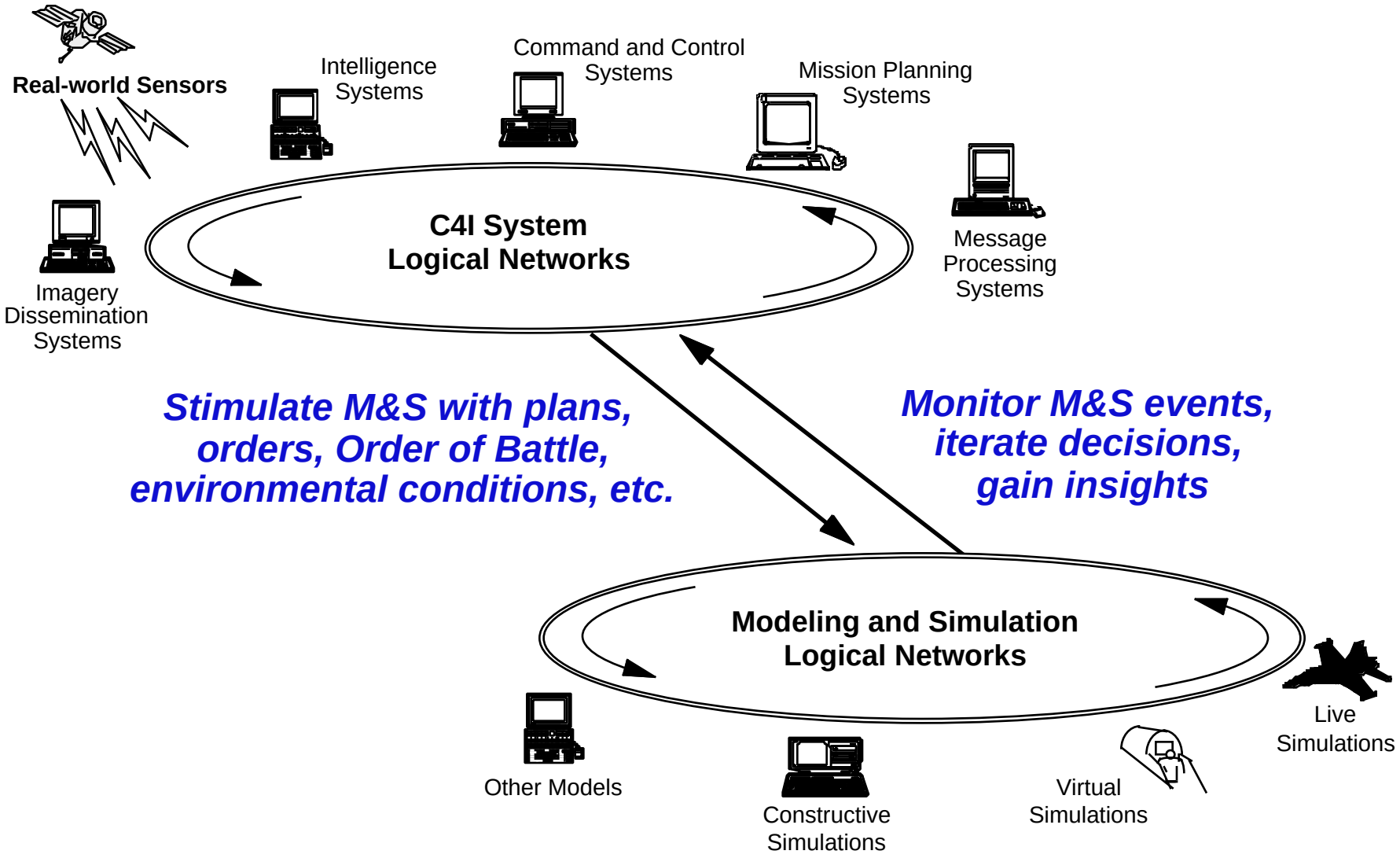
Concrete Results of CMMS Efforts

DMSO

- JSIMS and JWARS are sharing a common mission space model and intend to share knowledge acquisition
- JSIMS may leverage NASM business process re-engineering efforts
- Data Interchange Format (DIF) effort may provide far-reaching standardization results
- CMMS experiments will provide simulation developers useful ideas and products, saving time and money
  - JWARS now working with CMMS contractor
  - WARSIM prototyping an event view using NASM Domain Analysis methods
  - Operation Template capture tool available to developers

C4I-Sim Operational Concept

DMSO



C4I-Sim Interoperabilty Benefits

DMSO

Dual Goals: (1) Take M&S to War (2) Train as You Fight

- **Provide additional information to operational planners**
  - **weapons effects, sensor capabilities, etc.**
- **Provide additional insights/analysis regarding operational plans**
  - **potential dangers, conflicts, losses, and effectiveness**
- **Facilitate mission rehearsal**
- **Make it easier to use simulations for training**
  - **users interface with M&S using their own C4I systems**
- **Provide live C4I representations in simulation exercises**

More effective planning, rehearsal, and operations = more combat power

DoD M&S Master Plan Objective 1-1

DMSO

Objective 1-1. Establish a common high-level simulation architecture to facilitate the interoperability of all types of models and simulations among themselves and with C4I systems, as well as to facilitate the reuse of M&S components.

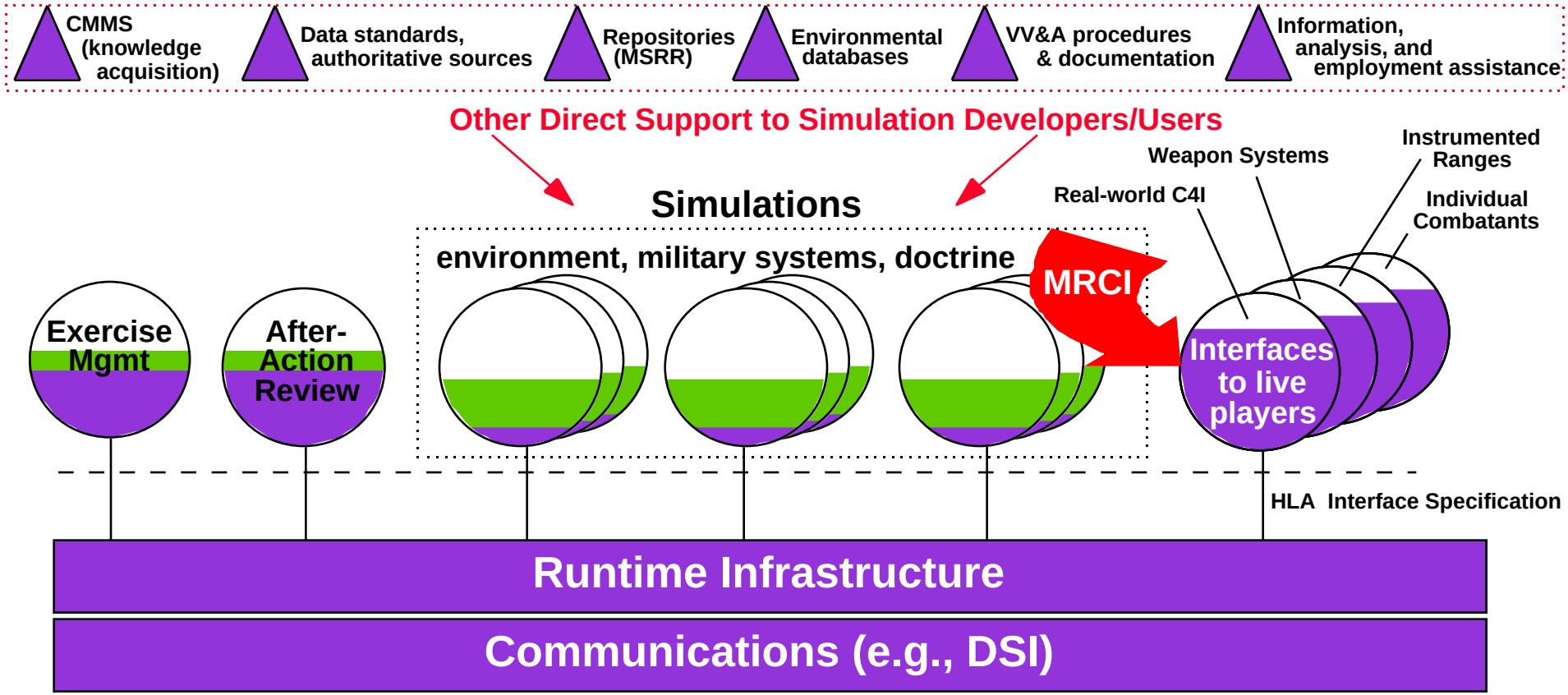
Purpose of MRCI Program

DMSO

To cost effectively support ‘seamless’ interfaces between C4I systems and simulations

Tomorrow's Simulations will be Built on Reusable Elements

DMSO

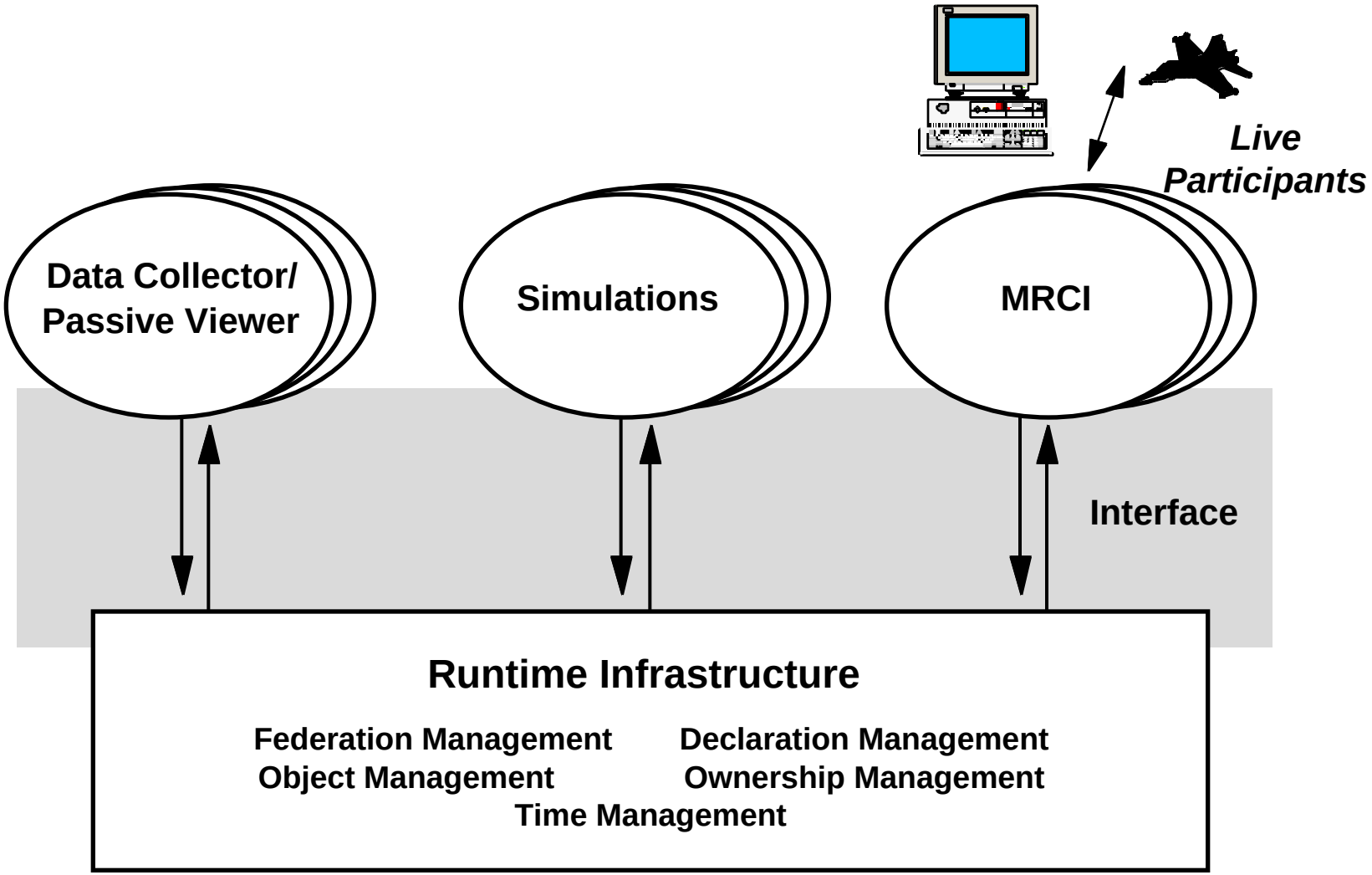


Key:

- developed once, reuseable across all DoD simulation systems
- developed once, reuseable across a simulation domain
- unique

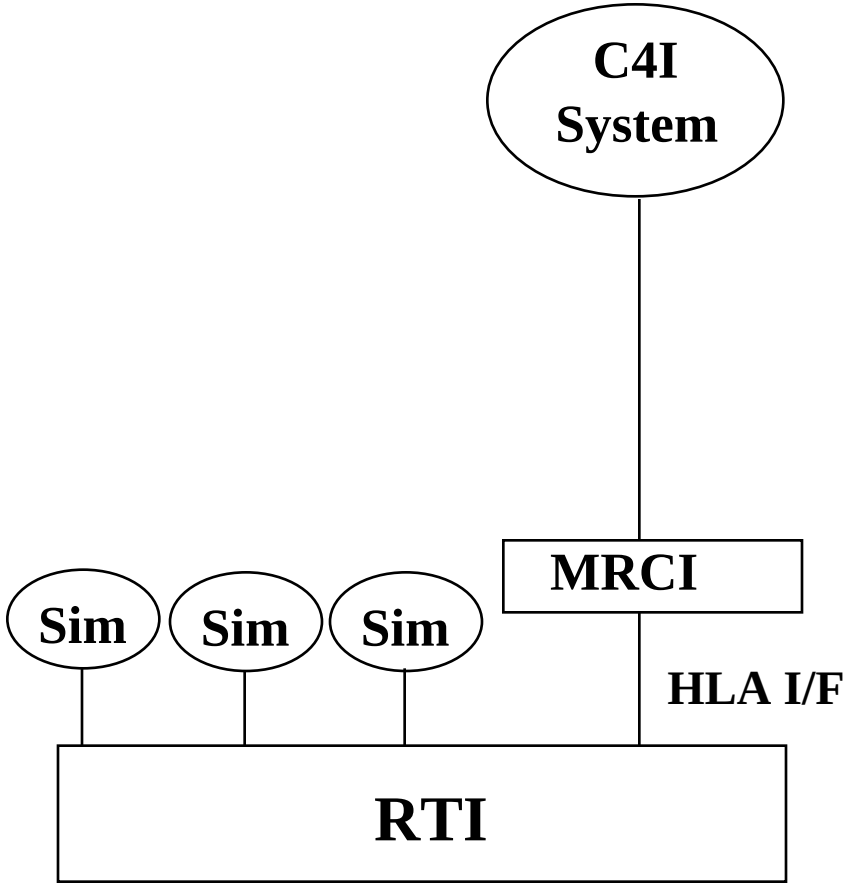
Functional View of the Architecture

DMSO



C4I to Simulation Functionality

DMSO

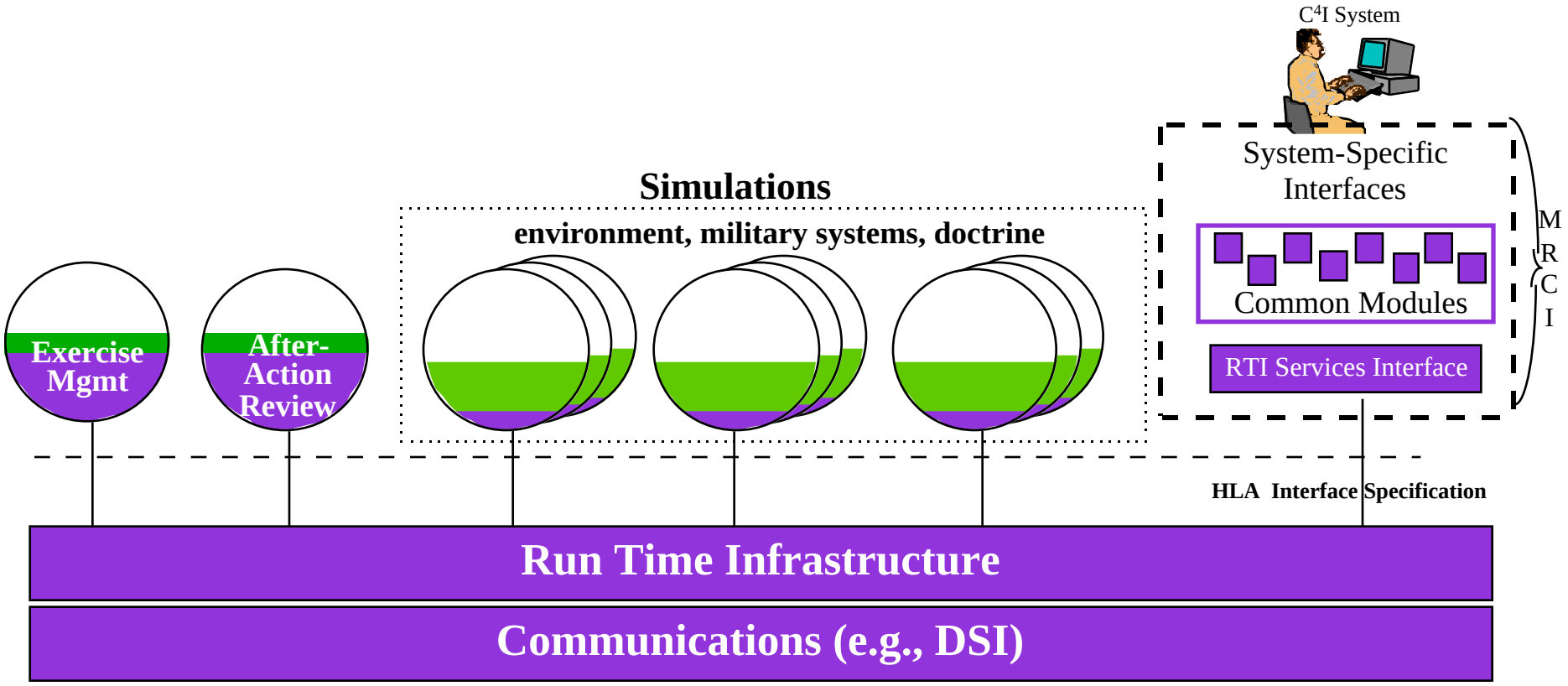


- **C4I information exchange**
  - Live system sends orders, reports, data etc. to simulated command nodes/systems
  - Simulated systems or command nodes send orders, reports, data to live systems
- **Ground truth exchange**
  - Simulated systems interact with (shoot, collide, jam) live systems
  - Live systems must send ground truth updates in accordance with FOM so simulation can project live system into simulated world*
- **Compliance with HLA I/F**
  - Appropriate use of RTI services*

* Artificialities due to simulation interface

MRCI Notional Design

DMSO



Key:

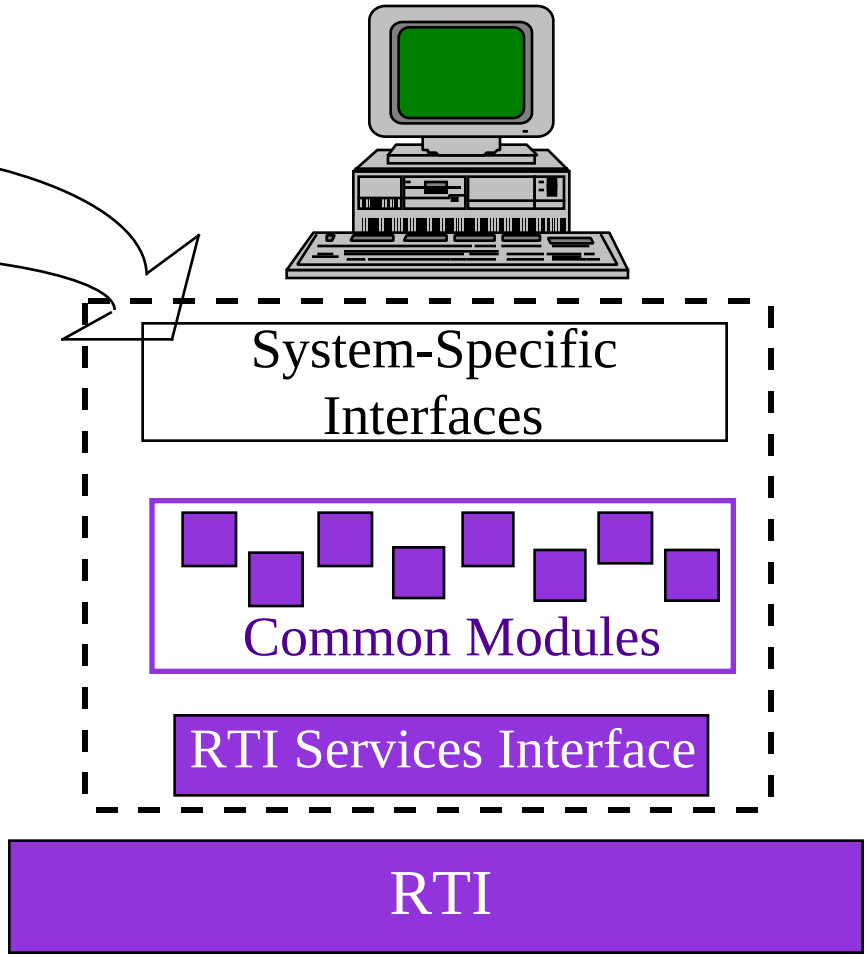
- developed once, reused across all DoD simulation systems
- developed once, reused across a simulation domain
- unique

Interface Specification

DMSO

Interface Spec & Software

1. **Intro/Purpose**
2. **Applicable Documents**
3. **Interface Summary**
   Cross-Index
4. **Signal Definition List**
5. **Narrative Signal Flow Table**
6. **Interdigital Processor**
   Communications
7. **Data Unit Description**
8. **Message Definition**

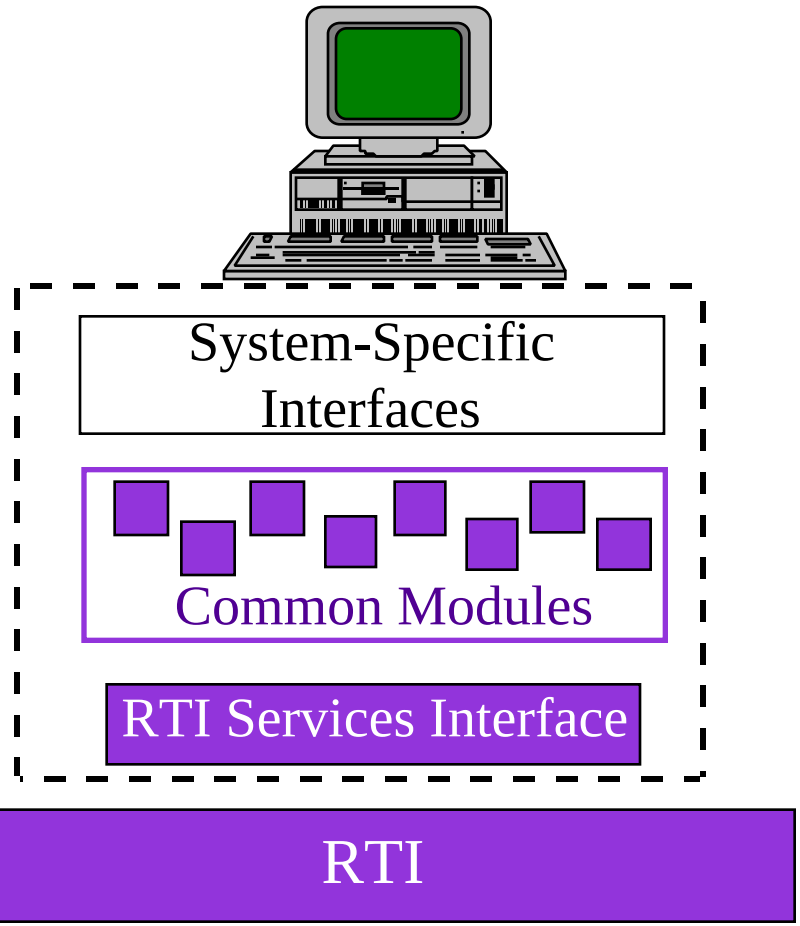


Run-Time Infrastructure

DMSO

HLA RTI

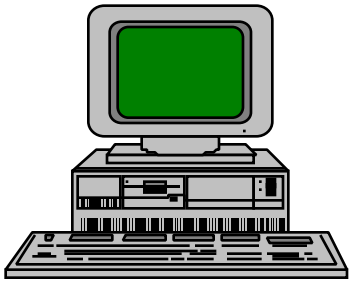
1. Federation Management
   e.g., Create, Pause, Resolve, Save,...
2. Declaration Management
   e.g., Publish Object, Subscribe, Control,...
3. Object management
   e.g., ID Request, Instantiate, Delete,...
   Send Interaction, Provide Attribute Value,...
4. Ownership Management
   e.g., Request Attribute Ownership Divestiture, Request Delete Privilege Acquisition,...
5. Time Management
   e.g., Set Federation Time, Request, Time Advance, ...

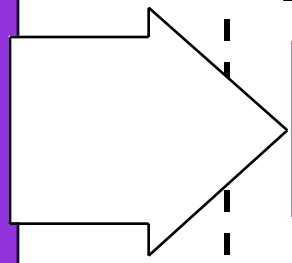


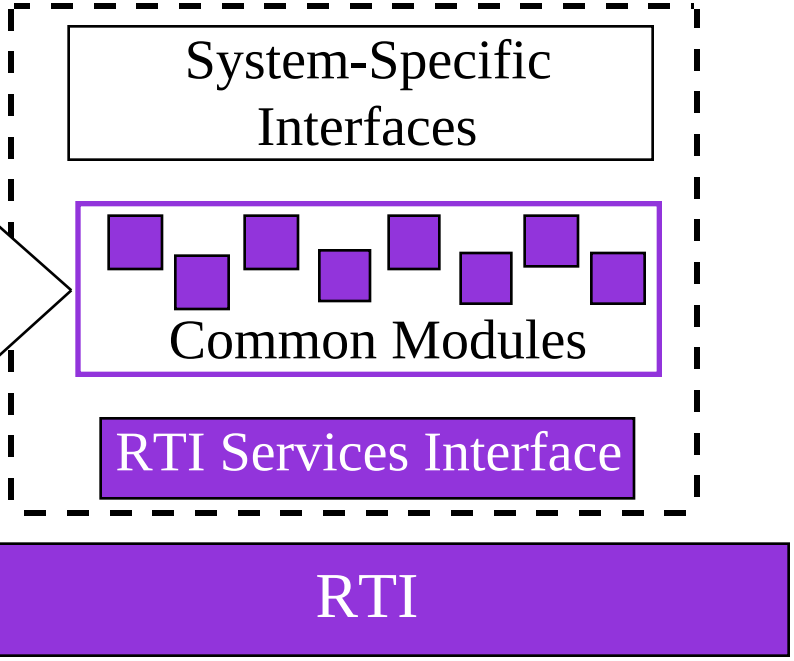
Common Modules

DMSO

MRCI Common Module Examples	
Technical Functions	Operational Functions
• Attribute Extrapolation • Data Collection • Implementing propagation effects	• Message & Datalink -Translation -Building -Transmission -Labeling



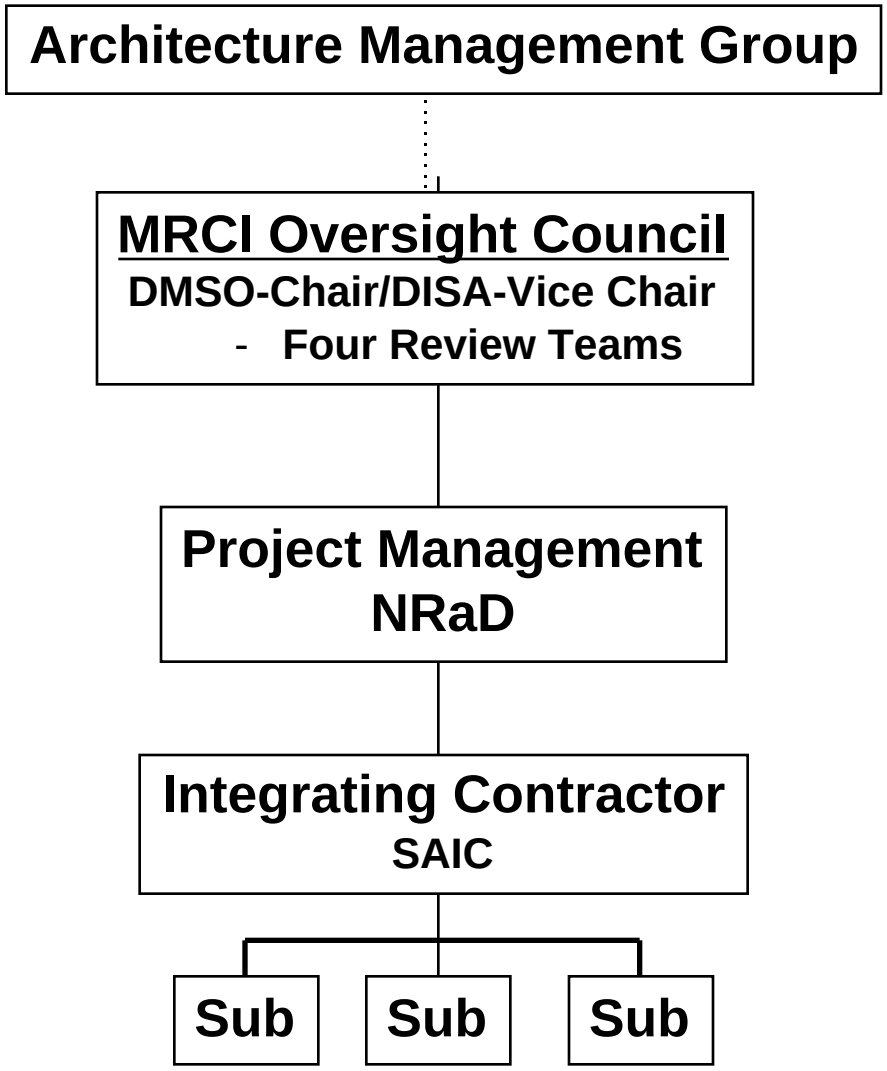




RTI

MRCI Organizational Structure

DMSO



Review Teams

DMSO

- Peer Review Team
  - Judith Dahmann - DMSO
  - John Diem - TEXCOM (CBS/ABCS)
  - Russ Richardson - SAIC (JPSD)
  - Marnie Salisbury - MITRE (STOW)
  - Jeff Wolford - Lockheed (TACCSF)
  - Martha Farinacci - MITRE (D8 - SIMLINK)
  - Joe Lacetera - MITRE (CECOM - SINCGARS)
  - Dan Sandini - MITRE (ESC)
  - Joe Jennings - MITRE (LAM TF)
  - Richard Wisehart - Frontier (CWIC)
- Simulation Program Review Team
  - JSIMS, STOW, WARSIM, NASM, BFTT, JTC/ALSP Review Panel, CATT, others
- Simulation Center Review Team
  - JWFC, JTASC, WPC, KBSC, NSC, BTS, others
- C4I System Review Team
  - GCCS (DISA - D8), Services, and others

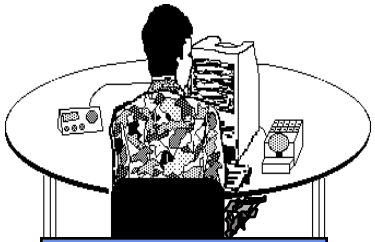
MRCI 1996 Prototypes

DMSO

- Four experiments planned
  - Air Force CTAPS <- HLA & MRCI -> AWSIM/R
  - Air Force CTAPS <- HLA & MRCI -> AFSAF
  - Army MCS/P & AFATDS <-HLA & MRCI -> CBS
  - Army MCS/P & AFATDS <-HLA & MRCI -> Army Synthetic Forces & CFOR
- DMSO is committed to carrying the common portions forward
- Programs/Services should carry “system specific aspects” forward

CTAPS <--> AWSIM/R

DMSO



CTAPS

M R C I

System-Specific Interface

X Z

RTI Services I/F

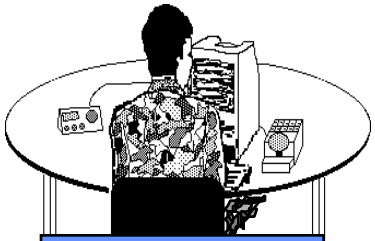
AWSIM/R (JTC)

RTI

COMMUNICATIONS/NETWORK

CTAPS <--> AFSAF

DMSO



CTAPS

MRCI

System-Specific Interface

X Y Z

RTI Services I/F

AFSAF

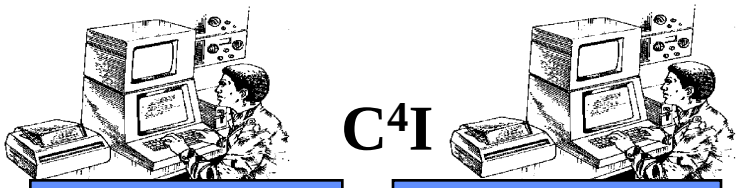
RTI Services Interface

RTI

COMMUNICATIONS/NETWORK

MCS/P & AFATDS <--> CBS

DMSO



C⁴I

MCS/P

AFATDS

CBS (JTC)

System-Specific Interface

System-Specific Interface

MRCI

X Y Z

RTI Services I/F

Z

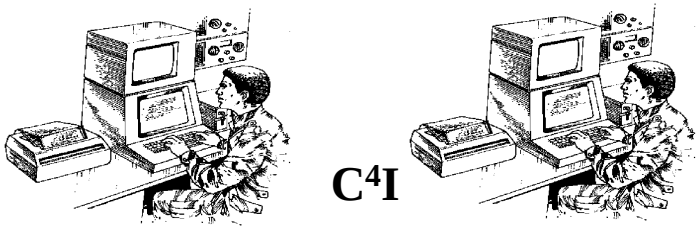
RTI Services I/F

RTI

COMMUNICATIONS/NETWORK

MCS/P & AFATDS <--> ARMY SF

DMSO



C⁴I

MCS/P

AFATDS

MRCI

System-Specific Interface

System-Specific Interface

X Y

Y Z

RTI Services I/F

RTI Services I/F

Army SF

CFOR

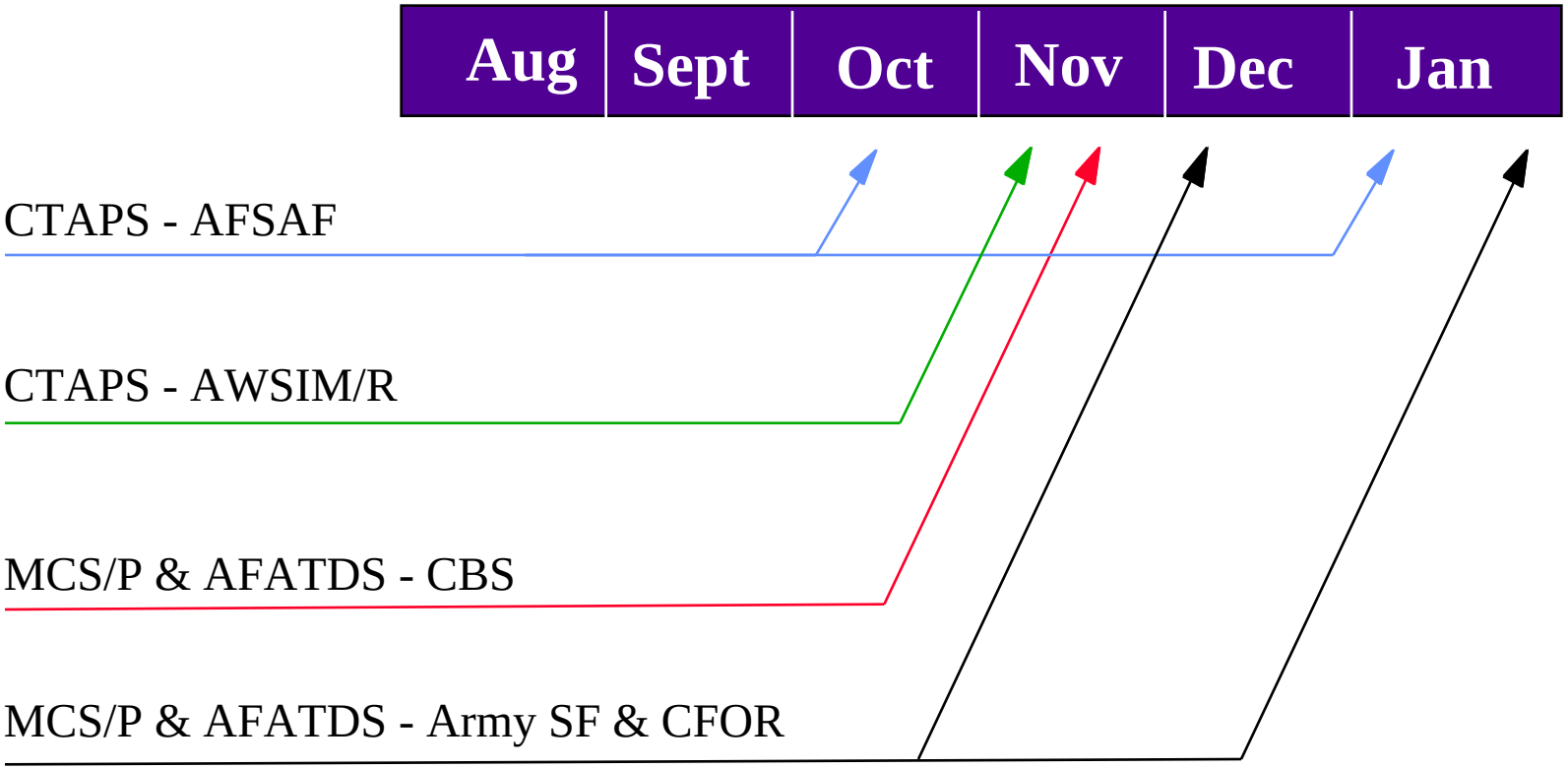
RTI Services Interface

RTI

COMMUNICATIONS/NETWORK

MRCI 1996 Schedule

DMSO



Summary

DMSO

- Goal of MRCI is to develop a reusable set of technical tools to support seamless interfaces between C4I systems and simulations
- Significant risk due to multiple dependencies
- Schedule
  - ‘96 -> 4 experiments
  - ‘97 -> additional experiments & competitive follow on
  - ‘98+ -> transition system-specific aspects while DMSO continues to support opportunities for open, reusable MRCI infrastructure